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Agrochemical Quality Assurance Management among Farmers for Improved Crop Production in South Eastern Nigeria

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Abstract: *This study was carried out to determine the quality assurance of farmers in agrochemical management for improved crop production in South Eastern Nigeria. The specific objectives of the study were to determine the quality assurance of farmers in identifying the types of agrochemicals to be used on crop, adhering to standards for agrochemical use, identifying the challenges in controlling the excessive use of agrochemicals, keeping safety measures for agrochemical use. Four research question were raised. A survey research design was used for the study. The population of the study was 384 individuals which comprised 186 Agricultural Extension Workers and 198 Crop Farmers. The instrument for Data Collection was a 51-item structured questionnaire, which was developed from literature reviewed. It was titled: Agrochemical Management Quality Assurance Questionnaire (AMQAQ). The instrument was validated by five (5) experts. The reliability coefficient of the instrument was .85 and .89 using Cronbach Alpha reliability method. The data collected was analysed using both descriptive and inferential statistics. Descriptive statistics such as arithmetic mean and Need Performance Index (NPI) were used to answer the research questions while inferential statistics of chi-square (precisely, chi-square test of goodness -of- fit) was used to test the null hypotheses at 0.05 level of significance. There was low quality assurance (LQA) on all the items investigated by this study. The findings among others revealed that crop farmers in the South Eastern Nigeria need to be assured of the quality of agrochemical and its proper management practices to improve crop performance so as to enable good production and reasonable farm produce. On the basis of the findings, it was recommended that policies on agrochemical management practices should be implemented by the government and non-governmental organizations to increase the adaptive level of farmers.*

Key words: Quality assurance, Agrochemical management, Crop Production

Introduction

Agrochemicals and their use in farming is seen as an integral part of agricultural production systems around the world to achieve significant productivity. The invention of many chemicals, which came after World War II to combat pests of human and animal diseases in tropical areas including Nigeria, has encouraged their rapid use in agriculture, as chemical industries provided an arsenal of over half a million chemical substances into the market (Smith & Smith, 2015). In Nigeria, the agricultural sector is the major supplier of food, industrial raw materials, and foreign exchange, and 70% of Nigeria's population largely depends on this sector for survival (Liverpool-Tasie, Kuku & Ajibola, 2011). But with the mounting pressure of growing populations, agriculture has been undergoing accelerated changes over the last century to sophisticated mechanized farming systems which have resulted to uncontrollable damage to the environment causing a lot

of pollution to air, water and soil (Rocket, 2007). Due to the country's drive to increase agricultural production and the upsurge of different species of pests that damage and ravage agricultural products in fie1ds and storage, farmers have resorted to the use of agrochemicals as an important control strategy (Maton, Dodo, Nelsla & Ali, 2016).

Agrochemical or agrichemical (agricultural chemical) is a chemical product used in agriculture for specific purposes. In most cases, agrichemical refers to pesticides including, insecticides, herbicides, fungicides and nematicides, molluscicide, piscicide, avicide, rodenticide, bactericide, insect repellent, animal repellent, disinfectant (antimicrobial), and sanitizer (Carolyn, 2013). It may also include synthetic fertilizers, hormones and other chemical growth agents, and concentrated stores of raw animal manure. Agrochemicals are generally referred to and considered as technology options for improving crop productivity through their effects on controlling diseases, pests and soil nutrient enhancements. Agro-chemicals include chemically synthesized compounds, devices or organisms that are routinely utilized in agriculture to manage, destroy, attack or repel pests, pathogens and parasites. They can be organic or inorganic moieties and may be classified into different groups based on their chemical composition such as organochloride, organophosphates, carbonates, formamidines, theocyanates, organotines, denitrophenols, synthetics pyrethroids and antibiotics (Bo & Linhai, 2010). Modern farming relies on the use of several agro-chemicals such as fertilizers, pesticides and crop preservatives to produce and preserve an abundance of high-quality food (Desalu, Busari & Adeoti, 2014). Their use has significantly increased productivity, and the risk of pesticides toxicity in food and in our environment, with associated negative short and long-term effects on crops and the farmer's health. Agrochemicals are used as soil conditioners, acidifiers and nutrients and are also used to control diseases caused by bacteria, fungi, pests, and viruses, thereby enhancing agricultural production and safety. Many agrochemicals are toxic and in bulk storage, may pose a significant environmental and/or health risks particularly in the event of accidental spills (Andrew, 2007).
According to Govinda (2014), though agrochemicals are costly inputs, balance use, optimum doses, correct methods, and right time of application ensure increased crop production. Despite their benefits, application of agrochemicals is often imprecise, with unintended worker exposures, and pose potential hazards to farmer's health and the environment when not properly handled. The application of Agrochemicals for the control of wide variety of insectivorous, herbaceous pests and green leaves since chemical age, have contributed enormously to the success of agricultural advancement globally, but with some noticeable pollution effects on ecosystem and human health (Beseler, Stallones & Hoppin, 2008).

The most common agrochemicals include pesticides and fertilizers (Encyclopedia, 2018). Pesticides and fertilizers are considered vehicles for improved crop production technology. The distribution of agro-chemicals to end-users is not often addressed by professionals. Researchers frequently carry out surveys based on official records of importation and sales collated by the government and its affiliated agencies (Agrochemical dealer), who are referred to as individual who is knowledgeable on the essential chemicals that are needed in crop production, identifying the type of agro-input, adhering to the standards of its use, the challenges in its excessive use handling and keeping safety measures, introduce them to farmers with information on the use to improve crop production with the help of agriculture extension worker. It is then an obligation of the agriculture extension worker to ensure that extension services are given to assure the quality usage of agrochemicals by farmers. Agricultural extension services are designed to "extend" research-based knowledge to the rural sector to improve the lives of farmers, by increasing their yields and production (Davis, 2008). Agricultural Extension worker is a professional in the

extension system responsible for developing individuals in the community, educating farmers and producers to help themselves and linking them with research-based information to enhance agricultural production, productivity, processing and marketing of agricultural goods and services. They offer technical advice on agriculture to farmers, and also supplies them with the necessary inputs and services to improve their agricultural production. An extension worker in this study is someone that operates as facilitator and communicator (transfer of technology and knowledge from agricultural research centers to farmers), helping farmers in their decision-making and ensures that appropriate knowledge is imparted to obtain the best results with regard to quality assurance, improved crop production and general rural development.

Quality assurance (QA) is the systematic measurement, comparison with a standard, monitoring of processes and an associated feedback loop that confers error prevention. Quality assurance includes two principles: "Fit for purpose" (the product should be suitable for the intended purpose); and "right first time" (mistakes should be eliminated). The two principles also manifest before the background of developing a novel technical product: Quality assurance comprises administrative and procedural activities implemented in a quality system so that requirements and goals for a product, service or activity will be fulfilled (Russell, 2018). In this context, quality assurance is the step taken to bring about increase in crop yield and food security with agrochemical use and ensures safety of users. In order, that administrative and procedural activities required to be implemented to improve crop production; good management practices, farmers, extension workers and agrochemical manufacturers or dealers are stakeholders.

Management is an act of achieving results by coordinating stakeholders' efforts. According to Krajewski, Ritzman, & Malhorta (2013) posited that in management, several types of decisions are made including operations strategy, product design, process design, quality management, capacity, facilities planning, production planning and inventory control. Each of these requires an ability to analyze the current situation (obsolete crop production practices) and find better solutions (agrochemical management) to improve the effectiveness and efficiency of service operations (improved crop production). Agrochemical management is the process of coordinating agro-dealers, farmer's and extension workers efforts in the use of the agrochemicals towards achieving an improved crop production which is encouraged and assured due to the standards or quality of its use, processes or procedures by a farmer.

In the view of Babu & Prabuddha (2009), a farmer is an individual whose primary job function involves livestock and/or crop production. A farmer takes all the necessary steps to enhance production and embraces the need of new and improved agro-chemicals to further cultivation of crops so as to bridge the gap in crop production through agrochemical use. As a result of this Rosett & Sheldon (2001) explained the difference between the perceived need (real performance) and actual need (expected performance). The authors stressed that need gap is obtained by subtracting the present performance level (PPL) from the actual need level (ANL). Berwick in Nwigwe (2009) considered need gap as the discrepancy between a current state of affairs and a desired future state. The authors maintained that it is the difference that exists between perceived need and felt need. Determination of the quality assurance of farmers in agrochemical management to improve crop production therefore requires need gap analysis.

Need gap analysis is described by Chuta (1999) as a technique for determining the steps to be taken in moving from a current state to a desired future state. It begins with listing of characteristic factors such as quality, standards and performance level of the present situation, cross listing of the factors required to achieve future objective and then highlighting the gaps that exist and needs

to be filled. Rosett and Sheldon (2001) recorded that need gap analysis is a tool that is used by a company or an individual to compare its actual performance with its potential performance. In this study, need gap analysis is the computation of the mean values of the perceived performance of the farmers subtracting from the computation of the mean values of their expected performance in crop production and agrochemical management. The result obtained as the need gap value will indicate the quality assurance of the extension worker to farmers on agrochemical management to improve crop production in South-East Nigeria. Specifically, the study was to determine:

1 quality assurance of farmers in identifying the types of agrochemicals to be used on crop;
2 quality assurance of farmers in adhering to standards for agrochemical use;
3 quality assurance of farmers in identifying the challenges in controlling the excessive use of agrochemicals;
4 quality assurance of farmers in keeping safety measures for agrochemical use;

Research Question

1 What is the quality assurance of farmers in identifying the types of agrochemicals to be used on crop?
2 What is the quality assurance of farmers in adhering to standards for agrochemical use?
3 What is the quality assurance of farmers in identifying the challenges in controlling the excessive use of agrochemicals?
4 What is the quality assurance of farmers in keeping safety measures for agrochemical use?

Methodology

The study adopted a survey research design. This design is suitable for this study because data was collected from a representative sample of the population using questionnaire and the findings were generalized on the entire population of the respondents in South Easter Nigeria.

The study was conducted in South Easter Nigeria. The population for this study was 589,431 individuals, made up of all the 365 agricultural extension workers and 589,066 crop farmers in all the south eastern states (Abia, Anambra, Ebonyi, Enugu and Imo States). The sample size for this study was 384 respondents comprising 186 agricultural extension workers and 198 crop farmers. This was estimated using Krejcie and Morgan Table (1970) to get the required figures at 95% confidence level, 5% confidence interval and 50% response distribution. Multistage sampling procedure was used to select the samples for the study. This sampling technique is suitable for this study because it involves simple random sampling and proportionate stratified techniques at different stages. Firstly, three out of the five States in the South-Eastern region- Abia, Ebonyi and Enugu were randomly selected through balloting without replacement. Simple random sampling technique gave all the states an equal opportunity of being selected for the study. Secondly, stratified proportionate sampling technique was used to stratify the sample size of 384 into recognized categories thus: 186 agricultural extension workers and 198 crop farmers. This was to ensure that all the strata or categories of respondents were selected for a valid result. The instrument for data collection was a structured questionnaire titled: Agrochemical Management Quality Assurance Questionnaire (AMQAQ) developed by the researchers from literature reviewed. It consisted of two parts; Part A sought for the bio data of the respondents, while Part B sought responses of items in four sections A-D based on the research questions for the study. A total of Ninety-nine (51) items. The questionnaire (AMQAQ) had two response categories of Needed and Performance. The needed category was rated by registered Agricultural extension workers because they are responsible for training and assisting farmers in improving their production activities and hence sets the standard of performance in all the indices of agrochemical management while the performance category was rated by registered crop farmers since they have

been using agrochemicals over time. Each AMQAQ item of the needed category had 4 rating scales of Highly Needed (HN), Averagely Needed (AN), Slightly Needed (SN), and Not Needed (NN) while each AMQAQ item of the performance category had 4 rating scales of High Performance (HP), Average Performance (AP), Low Performance (LP), and No performance (NP) with corresponding nominal values of 4, 3, 2, and 1 respectively for both categories.

The instrument (AMQAQ) was subjected to face and content validation by five experts: three from Department of Crop Production, Joseph Sarwuan Tarka University, Makurdi; one from Department of Educational Foundation and General Studies and the other, from Department of Agricultural Education of the same institution, Each of the experts was given a copy of the questionnaire and requested to read the items thoroughly, to correct any wrongly spelt words, ambiguous or unclear statement and wrong information on the questionnaire items which were used to improve the AMQAQ for final production. To establish the reliability of the instrument, a trial testing was conducted. The test for reliability was conducted in North Central State of Nigeria (Benue State) where the respondents have some similar characteristics with those in the study area. Thus, the trial test of the research instrument (AMQAQ) was administered to 35 respondents; 15 Agricultural extension workers and 20 crop farmers randomly selected from Benue State in the North Central Zone of Nigeria. The responses of respondents were analyzed using Cronbach Alpha reliability method to determine the internal consistence of the instrument which yielded 0.85 and 0.89 for the needed and performance categories respectively. This indicates that the instrument (AMQAQ) is reliable and valid for the study. An on the spot method of questionnaire administration and retrieval were used. The researcher employed the assistance of three research assistants (one from each state) to help in the administration of the AMQAQ on the respondents in their respective states. The research assistants were briefed on what to do when distributing and retrieving the copies of the questionnaire from the respondents. A total of 384 copies of the questionnaire were distributed to the respondents by the researcher and research assistants. The research assistants retrieved the questionnaire from the respondents when they finished checking their response options on questionnaire items. The researcher went around to collect the retrieved questionnaire from the research assistants at some agreed places in each of the states. All 384 copies of the questionnaire were returned and used for data analysis.

The data was analyzed using both descriptive and inferential statistics. Descriptive statistics such as arithmetic mean and Need Performance Index (NPI) were used to answer the research questions while inferential statistics of chi-square (precisely, chi-square test of goodness -of- fit) was used to test the null hypotheses at 0.05 level of significance. Chi-square statistic measures the relationships between variables when the data of the research consist of frequencies in discrete categories with independent subjects with data collected at nominal level. Chi-square test of goodness -of- fit tells us if there is a statistical significant difference between the observed set of frequencies and expected set of frequencies and is used when we have only one set of variables with the number of levels of categorical variables (response options) hence the degree of freedom is always K-1 and is determined *a priori* not *posteriori.* The choice of chi-square test of goodness -of- fit was because the study sought to determine whether crop farmers in South Eastern Nigeria would significantly possess low quality assurance in all the indices of agrochemical management where the researcher established whether or not, an observed or actual performance (performance category) differs from a theoretical standard or expected performance (needed category). Hence the discrepancy or difference between an observed performance and the expected performance (standard) of crop farmers on various components of agrochemical management was determined. Chi-square test of goodness -of- fit will help determine how well the observed frequencies fits the

expected theoretical frequencies. To determine the quality assurance of crop farmers in agrochemical management for improved crop production in South Eastern Nigeria, the following steps were taken:

The arithmetic mean under the needed category ($\bar{X}_n$) was calculated for each item

The arithmetic mean under the performance category ($\bar{X}_p$) was calculated for each item.

The difference between the two arithmetic means for each item **($\bar{X}_n$ - $\bar{X}_p$)** was determined to give the Need-Performance Index (NPI) which indicates the level of quality assurance of farmers on each item.

Inference from the calculation is as follows:

Where the need performance index (NPI) equals zero (0) for each item, it indicates good quality assurance because the level at which the item is needed as indicated by the arithmetic mean is equal to the level at which the farmers could perform that particular task.

Where the need performance index (NPI) was negative (-) for each item, it represents high quality assurance because the level at which the item is needed is lower than the level at which the farmers could perform that particular task.

Where the need performance index (NPI) is positive (+) for each item, it means low quality assurance because the level at which the item is needed is higher than the level at which the farmers could perform that particular task.

The Need Performance Index (NPI) values obtained will be further categorized for coding in testing hypotheses as follows:

2.00 and above will be coded as very high Need-Performance Index (NPI)

1.5-1.99 will be coded as high Need-Performance Index (NPI)

1-1.49 will be coded as low-Performance Index (NPI)

0-0.99 will be coded as very low Need-Performance Index (NPI)

The decision rule for rejection or otherwise of hypotheses was based on the p-value and alpha value. A hypothesis of no significant low-quality assurance was not rejected for any cluster of items.

Results

The results of this study are based on questions answered and hypotheses tested and presented in table 1 to 4.

Table 1: Quality Assurance of Farmers in Identifying the Types of Agrochemicals to be Used on Crops

S/N	Types of Agrochemicals	$\bar{X}_n$	$\bar{X}_p$	NPI ($\bar{X}_n$ - $\bar{X}_p$)	Remarks
1	Identify the insecticides used for insect pests on crops	3.72	2.05	1.67	LQA
2	Identify herbicides formulations	3.65	2.36	1.29	LQA
3	Identify pre-emergence herbicides that kill weed seeds before they germinate	3.65	2.25	1.40	LQA
4	Identify post-emergence herbicides to be used by farmers	3.64	2.40	1.24	LQA
5	Use contact herbicides to kill weed plant tissue	3.59	2.42	1.17	LQA
6	Apply systemic herbicides on target weeds	3.01	2.41	0.60	LQA
7	Identity glyphosate as herbicide that works through downward movement from the leaves	3.43	2.41	1.02	LQA
8	Use soil sterilants at high rate to keep the soil free from vegetation for a period of time	3.42	2.41	1.01	LQA
9	identify soil fumigants that can be used to control soil pests	3.52	2.42	1.10	LQA
10	Identify insecticides that have the ability to prevent, destroy, repel, or mitigate any insect pests when applied	3.52	2.46	1.06	LQA
11	Identify the selective herbicides to kill the weed on the farm	3.41	2.47	0.94	LQA
12	Apply the Non-selective herbicides that kills all plants they come in contact with	3.2	2.46	0.74	LQA
13	Distribute organic pesticide residues in soil, water and crops especially cereals	3.34	2.39	0.95	LQA
14	Identify fungicides that protect crop against attack from fungal pathogens	3.38	2.45	0.93	LQA
15	Apply rodenticides to kill rodents that attack the crops	3.55	1.97	1.58	LQA
16	Apply plant growth regulators to enhance reproduction rate of crops	3.67	1.96	1.71	LQA
	Grand NPI	**3.48**	**2.33**	**1.15**	**LQA**

Key: *$\bar{X}_n$ = Mean of Needed Category, $\bar{X}_p$ = Mean of Performance Category, NPI = Needed-Performance Index, LQA = Low Quality Assurance*

Data in Table 1 reveals that all the 16 items have need-performance index that range from 0.60 to 1.71, with a grand index of 1.15 and were positive. This result indicates that the the quality

assurance of farmers in identifying the types of agrochemicals to be used on crops in South Eastern Nigeria is low.

Table 3: Quality Assurance of Farmers in Adhering to Standards for Agrochemical Use

S/N	Standards for Agrochemical Use	$\bar{X}_n$	$\bar{X}_p$	NPI ($\bar{X}_n$ - $\bar{X}_p$)	Remarks
1	Regulate and monitor Agrochemical use	3.62	1.96	1.66	LQA
2	Purchase approved agrochemicals by the government.	3.57	1.93	1.64	LQA
3	know registered pesticides and permission status	3.45	1.96	1.49	LQA
4	Control quality and to improve crop production.	3.58	1.97	1.61	LQA
5	use agrochemical correctly to avoid its residues on crops	3.40	1.96	1.44	LQA
6	Determine manufactures of agrochemical to ensure the best interest of the farmers and the environment are well protected.	3.38	1.97	1.41	LQA
7	Formulate adequate consideration for farmers' health and the environment.	3.47	1.95	1.52	LQA
8	Implement and enforce of policies.	3.50	1.93	1.57	LQA
9	Procure Agrochemical from open markets is prohibited to control adulterated	3.33	2.04	1.29	LQA
10	Use less persistent pesticides in crop production.	3.53	2.03	1.50	LQA
11	Use pesticides for spraying the right crops.	3.61	2.04	1.57	LQA
12	Abstain from spraying during rain.	3.44	2.02	1.42	LQA
	Grand NPI	**3.49**	**1.98**	**1.51**	**LQA**

Key: $\bar{X}_n$ = *Mean of Needed Category*, $\bar{X}_p$ = *Mean of Performance Category, NPI = Needed-Performance Index, LQA = Low Quality Assurance*

Data in Table 2 reveals that all the 12 items have need-performance index that range from 1.29 to 1.66, with a grand index of 1.51 and were positive. This result indicates that the the quality assurance of farmers in adhering to standards for agrochemical use in South Eastern Nigeria is low.

Table 3: Quality Assurance of Farmers in Identifying the Challenges in Controlling Excessive Use of Agrochemicals in South Eastern Nigeria

S/N	Challenges in Controlling Excessive Use of Agrochemicals	$\bar{X}_n$	$\bar{X}_p$	NPI ($\bar{X}_n$ - $\bar{X}_p$)	Remarks
1	Identify Pesticides resistance due to excess use	3.42	1.79	1.63	LQA
2	Spend more on pesticides each year just to keep crop losses at minimum	3.50	1.63	1.87	LQA
3	Handle and apply agrochemicals by crop farmers.	3.54	2.01	1.53	LQA
4	Monitor pesticide residues by the government on locally-consumed products.	3.55	1.91	1.64	LQA
5	Reward farmers whose produce have safe levels of pesticide residues.	3.38	1.89	1.49	LQA
6	Read the instructions on the label of the pesticides containers by the crop farmers.	3.47	2.05	1.42	LQA
7	Identify insufficient information or awareness on fake and substandard chemicals by agro-dealers.	3.66	1.89	1.77	LQA
	Grand NPI	**3.50**	**1.88**	**1.62**	**LQA**

Key: $\bar{X}_n$ *= Mean of Needed Category,* $\bar{X}_p$ *= Mean of Performance Category, NPI = Needed-Performance Index, LQA = Low Quality Assurance*

Data presented in Table 3 reveals that all the 7 items have need-performance index that range from 1.42 to 1.87, with a grand index of 1.62 and were positive. This result indicates that the quality assurance of farmers in identifying the challenges in controlling excessive use of agrochemical in South Eastern Nigeria is low.

Table 4: Quality Assurance of Farmers in Keeping Safety Measures for Agrochemical Use in South Eastern Nigeria

S/N	Keeping Safety Measures for Agrochemical Use	$\bar{X}_n$	$\bar{X}_p$	NPI ($\bar{X}_n$ - $\bar{X}_p$)	Remarks
36	Apply pesticides only when and where necessary.	3.45	2.01	1.44	LQA
37	Choose the right equipment for applications of agrochemicals.	3.47	1.83	1.64	LQA
38	Spray against the wind	3.46	1.71	1.75	LQA
39	Wear protective clothing during application.	3.42	1.70	1.72	LQA
40	Use protective cloth so as not to touch the skin.	3.17	1.81	1.36	LQA
41	Vary the soil and crop factors of a given field.	3.33	1.75	1.58	LQA
42	Use of biological pest controls (such as pheromones and microbial pesticides).	3.45	1.76	1.69	LQA
43	Direct fewer chemicals and more "green products".	3.50	1.76	1.74	LQA
44	Close the sprayer while not in use.	3.47	1.81	1.66	LQA
45	Avoid spilling of herbicide when loading.	3.44	2.00	1.44	LQA
46	Avoid dumping of unused herbicides in anything except a designated holding tank.	3.48	2.03	1.45	LQA
47	Clearly read and understand the Product Labels before use.	3.58	2.01	1.57	LQA
48	Read hazard warnings stated on every pesticide is to be adhered to.	3.56	1.64	1.92	LQA
49	Avoid transport of highly-volatile pesticides in separate trips from other chemicals to be observed	3.58	1.99	1.59	LQA
50	Mix the pesticides outdoors where there is good ventilation and light.	3.53	1.99	1.54	LQA
51	Absorb any spillage with inert absorbent materials or sand.	3.47	1.89	1.58	LQA
	Grand NPI	**3.46**	**1.86**	**1.60**	**LQA**

Key: $\bar{X}_n$ *= Mean of Needed Category,* $\bar{X}_p$ *= Mean of Performance Category, NPI = Needed-Performance Index, LQA = Low Quality Assurance*

Data presented in Table 4 reveals that all the 16 items have need-performance index that range from 1.36 to 1.92, with a grand index of 1.60 and were positive. This result indicates that the the

quality assurance of farmers on keeping safety measures for agrochemical use in South Eastern Nigeria is low.

Discussion of Findings

The findings of the study revealed that farmers have low quality assurance in identifying the types of agrochemicals to be used for improved crop production in South Eastern Nigeria. The types of agrochemicals where farmers possess low quality assurance in identifying were: identify the insecticides used for insect pests on crops, identify herbicides formulations, identify Pre-emergence herbicides that kill weed seeds before they germinate, identify post-emergence herbicides to be used by farmers, use contact herbicides to kill weed plant tissue, apply systemic herbicides on target weeds, identity glyphosate as herbicide that works through downward movement from the leaves, use soil sterilants at high rate to keep the soil free from vegetation for a period of time, identify soil fumigants that can be used to control soil pests, identify insecticides that have the ability to prevent, destroy, repel, or mitigate any insect pests when applied, identify the selective herbicides to kill the weed on the farm, apply the non-selective herbicides that kills all plants they come in contact with, distribute organic pesticide residues in soil, water and crops especially cereals, identify fungicides that protect crop against attack from fungal pathogens, Apply rodenticides to kill rodents that attack the crops and apply plant growth regulators to enhance reproduction rate of crops. The findings agree with Ogunlade, Atibioke, Ladele and Adumadehin (2012) who carried out a study on Capacity of Agro-input dealers in advisory service delivery to maize crop farmers which showed that input dealers performed extension activities most especially on seed management and appropriate choice of agro-chemicals. They seldom advised farmers on the type of agrochemicals to use. There appeared to be a weak linkage with Extension Agents, Research Institute and Credits Institutions towards the farmers and leads to low quality assurance of farmers in identifying the type of agrochemical to use.

This study found that the quality assurance of farmers in adhering to standards for agrochemical use is significantly low in south eastern Nigeria. This finding is in agreement with the work of WHO (2010) who revealed that Pesticide registration is an important step in the management of pesticides as it enables authorities primarily to determine which pesticide products are permitted to be used and for what purposes, and also to exercise control over quality, usage rates, claims, labelling, packaging and advertising of pesticides, thus ensuring that the best interest of end-users as well as the environment are well protected. This corroborates the findings of World Bank WAAPP (2013) that about 72% of farmers in Nigeria procured their inputs from open markets which have high chance of adulteration and fake input products. This is to routinely subject any imported chemicals or foods to inspection and analysis at the port of entry, retail level and also perform laboratory analysis so as to adhere to its standards of use.

The results of the study revealed that the quality assurance of farmers in all the seven items on identifying the challenges in controlling excessive use of agrochemicals in South Eastern Nigeria is low. The challenges in controlling the excessive use of agrochemicals by crop farmers were: Pesticides resistance due to excess use, spend more on pesticides each year just to keep crop losses at minimum, handle and apply agrochemicals, monitor pesticide residues by the government on locally-consumed products, reward farmers whose produce have safe levels of pesticide residues, read the instructions on the label of the pesticides containers, identify insufficient information or awareness on fake and substandard chemicals by agro-dealers. These results were collaborated by the results of the corresponding hypotheses in Table 8 which shows that farmers in South Eastern Nigeria significantly possess low quality assurance in identifying the challenges in controlling excessive use of agrochemicals.

The above finding is in agreement with the findings of Lamichhane, *et al*, (2016) who found that the major risks associated with frequent use of pesticides and fertilizers are soil and water pollution, the emergence of resistant strains of weeds and pests to pesticides, ecological instability, and toxicity to the human and other organisms. The findings of Dubey et al., (2012) also revealed that the widespread use of pesticide for agricultural and non-agricultural purposes has resulted in the presence of their residues in various environmental matrices (Dubey et al., 2012). Furthermore, the findings of Emoghene and Futughe (2016), also revealed that in developing countries like Nigeria, agricultural practices still rely heavily on agrochemicals to prevent and/or control the crops disease. This dependent of the chemicals leads to its use in excess on crop and the farmers need to be properly guided to improve its management.

Even more unfortunate is the reality that crops such as beans, sesame seed, pepper, etc that are rejected by foreign buyers on account of high level of residual pesticides are invariably returned to the country to be sold and consumed by unwary Nigerian public (AuwalAhmad and Awoyale, 2008). As pointed out by the PAN, "As "superbugs" and "superweeds" develop in response to widespread and continuous use of chemicals, a farmer will spend more on pesticides each year just to keep crop losses at a standard rate" (PANA, 2016b). It is ironic that manufacturers of pesticides are using the problem so generated to promote genetically modified crops. Quality Input (agrochemical inclusive) remains a major factor that can enhance the performance of enterprises in Nigeria (Manyong, *et al.,* 2015) but unfortunately, Nigerian input distribution has been characterized by inefficiencies and abuses (Akinyosoye, 2005).

Findings of quality assurance of farmers on keeping safety measures for agrochemical use on Table 4 revealed that crop farmers in South Eastern Nigeria have low quality assurance in keeping safety measures for agrochemical use. Such safety measures were: application of pesticides only when and where necessary, choose the right equipment for applications of agrochemicals, spray against the wind, wear protective clothing during application, use protective cloth so as not to touch the skin, vary the soil and crop factors of a given field, use of biological pest controls (such as pheromones and microbial pesticides), direct fewer chemicals and more "green products". Close the sprayer while not in use, avoid spilling of herbicide when loading, and avoid dumping of unused herbicides in anything except a designated holding tank. This is in consonance with the work of Smith (2019) which states that contaminated products are quarantine and be subjected to seizure and destruction by NAFDAC and possible prosecution. Similarly, Miller (2015) found that Potential alternatives to pesticides are available and include specific methods of plant cultivation, use of biological pest controls (such as pheromones and microbial pesticides), plant genetic engineering, and methods of interfering with insect breeding. Furthermore, Adamu and Abebe (2022) found that Farmers should be able to read the labels and information instructions contained in the packaging so that they can practice good pesticide use to prevent contamination of the environment and agricultural products.

Based on the findings of this study, it was concluded that crop farmers in South Eastern Nigeria possess low quality assurance in all areas of agrochemical management because they were found deficient in agrochemical management practices and may need to enhance their capacity through re-training in order to improve production in the zone.

Recommendations

Based on the findings of the study, the following were recommended;

- Awareness should be created at all levels by agricultural extension workers on identifying the types of agrochemicals to be used on crops.
- Appropriate policies on agrochemical management practices should be put in place by federal ministry of Agriculture and non-governmental organizations to increase the adaptive level of farmers.
- Crop farmers should be mindful of the practices like; adhering to standards for agrochemical use, the challenges in controlling the excessive use and keeping safety measures of agrochemicals in the study area which should be enhanced by government through more extensive campaigns at village squares, radios, televisions, newspapers and other available means by agricultural extension workers to improve crop performance.
- Farmers should be adequately trained by agricultural extension workers on the cost-effective approaches that prevents and controls crop loses in agricultural production.

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